Various Litter Species and High Water-Table Levels Hamper Type II Methanotrophs in a Bare Peatland Regeneration Experiment

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Significant areas of temperate bogs have been damaged by peat harvesting. After abandonment and spontaneous regeneration, these secondary mires can become important methane sources towards the atmosphere (Basiliko et al., 2007). Recent studies have shown the importance of methane oxidising bacteria (MOB) for the recycling of carbon from methane effluxes (e.g., Dedysh et al., 2001; Raghoebarsing et al., 2005).

We set up a factorial experiment that allowed us to tests the effects of three levels of naturally fluctuating water table depths (13, 22, 35 cm) crossed with the effects of four different litter types (control, *E. vaginatum, E. angustifolium, S. fallax*). With help of improved 16 rRNA fluorescent in-situ hybridisation techniques we quantified the number of type II methane oxidising bacteria (MOB) living at different depths and just bellow the surface.

The results show that the water table can strongly influence the active type II methan-otrophs living in the first 5 cm of the regenerating bare peat. These methane oxidis-ing bacteria were also hampered by the presence of plant litter placed on top of the bare peat surface. This could have important implication for the methane oxidation potential of methane and on restoration management practices.

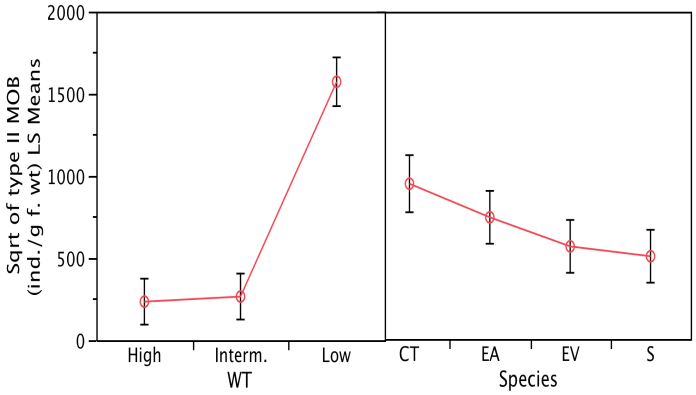

Figure 1: Modeled least square means of the number of living type II methanotrophs per gram fresh weight in fonction of : a) the water table depths (High=13 ; Interm=22 ; Low=35) and b) various litter species (CT=control ; EA=E. angustifolium ; EV=E. vaginatum ; S=Sphagnum fallax). Square-root transformed values. Error bars = ± SEM

Literature Cited

Basiliko, N., Blodau, C., Roehm, C., Bengtson, P., and Moore, T.R. (2007) Regulation of decomposition and methane dynamics across natural, commercially mined, and restored northern peatlands. *Ecosystems* 10: 1148-1165.

Dedysh, S.N., Derakshani, M., and Liesack, W. (2001) Detection and enumeration of methanotrophs in acidic Sphagnum peat by 16S rRNA fluorescence in situ hybridization, including the use of newly developed oligonucleotide probes for Methylocella palustris. *Applied and Environmental Microbiology* 67: 4850-4857.

Raghoebarsing, A.A., Smolders, A.J.P., Schmid, M.C., Rijpstra, W.I.C., Wolters-Arts, M., Derksen, J., Jetten, M.S.M., Schouten, S., Damste, J.S.S., Lamers, L.P.M., Roelofs, J.G.M., den Camp, H., and Strous, M. (2005) Methanotrophic symbionts provide carbon for photosynthesis in peat bogs. *Nature* 436: 1153-1156.

Contrasted Relationships Between Type I and Type II Methanotrophs, The Conditions Found in Typical Regeneration Stages Across European Peatlands and the Elapsed Time Since Abandonment of the Peat Cutting

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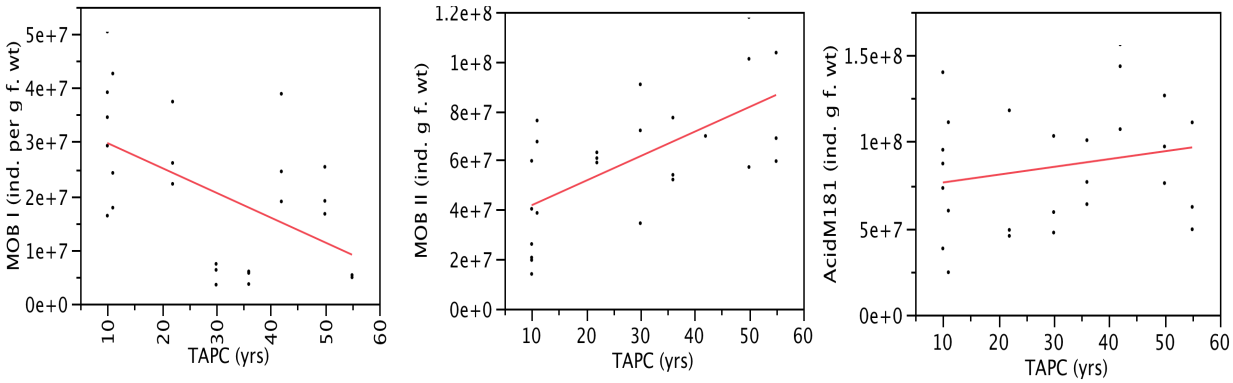

Fig. 1. Number of living methane oxidizing bacteria (MOB) per gram fresh weight of peat related to the regeneration time after abandonment of the peat cutting (TAPC), one of the most explanatory descriptor found in the multivariate analyses expressing the multiple ecological gradients four along four European peatlands. MOB I = type I methanotrophs (probes: M-84 and M-705), MOB II = type II methanotrophs (probe: M-450), AcidM181 = Methylocystys palustris and M. acidiphila B2 (includes the older: Mcaps 1032 and Mcell-1026).